

In the Specification

Please replace the paragraph found on page 7, lines 7-18 of the application with the following paragraph:

Figure 7 shows a short pulse hard x-ray source and an image switching technique to rapidly form a reflecting electron plasma to gate out the scattered x-rays from the image. Short pulse x-rays can be directly produced by, for example, a Fexitron Marks bank generator 71 or a short pulse laser 72 incident onto a metallic Tantalum target 73 (as shown by dotted lines). Other materials can be used as a target in order to achieve desired x-ray characteristics as a function of wavelength, power, and spatial uniformity. Using these techniques, as well as others known in the art, a wide range of x-ray energies, for example, from 15 to 600 keV, can be produced.

Please replace the paragraph found on page 8, line 25 through page 9, line 27 of the application with the following paragraph:

Figure 3 shows a specific embodiment of a hollow waveguide delivery system 30 for delivery of externally generated short pulse x-rays 32. The subject system offers advantages as compared to research with respect to the use of short pulse x-rays for restenosis treatment currently being undertaken in which an x-ray radiation tube is inserted inside the arteries along with the high voltage cables. In particular, there are advantages to the production of the radiation outside the patient and delivering it through hollow waveguides 31. These systems can rival conventional optics in both efficiency of delivery and in cost. Hollow waveguides can have less attenuation in the x-ray region than at longer wavelengths (the ultraviolet and infrared). The position of the hollow waveguides can be guided with the aid of conventional x-ray to the proper location in the artery, in a manner similar to that used as with balloon angioplasty. The subject method can be accomplished without high voltage cables inserted into a patient and, therefore, can avoid harm to doctors and patients from high voltage. Advantageously, the subject method can provide beam homogeneity, precise aperture of the waveguides allowing precise dose measurements, and minimization of the exposure to normal tissues.

Solid waveguides can also be utilized to transport x-ray irradiation in accordance with the subject invention. Specific embodiments of solid waveguides can incorporate reflective layers in the solid waveguides. With respect to hollow waveguides, reflective coatings can be applied to the inner

surface 34 in a variety of methods, as known in the art. In a specific embodiment, the hollow waveguide can be slit open, the reflective coating applied, and the waveguide glued back together. Materials which can be utilized to produce the subject waveguides include, but are not limited to, glass, plastic, and metal.

In order to produce a uniform, cylindrical pattern of x-ray irradiation pattern on the walls of the artery, a cylindrical or conical reflective tip 91 can be mounted on the end of the hollow taper 92 and waveguide 93 combination as shown in Figure 9. Figure 9 shows the hollow taper 92, waveguide 93, and a delivery tip 91. The delivery tip 91 can reflect the radiation uniformly through the clear walls of the glass tube 94 surrounding the tip. As the uniform Gaussian x-ray beam falls over the cylindrical surface of the reflector, the conical tip 91 reflects a uniform irradiation of the walls of the artery. When the x-ray output delivery at the waveguide is multimode, a very small hollow taper 92 at the waveguide output 95 can be used to get smooth Gaussian x-ray beam profile. Reflective tips of various designs can be utilized with the subject invention. For example, the tip can be convex, concave, linear, or any other shape which will produce the desired output pattern of x-ray irradiation toward the target site. In a specific embodiment, the reflecting tip can have a first portion of glass surrounded by a second portion of glass having a different index of refraction than the first portion of glass such that an outer surface of the reflecting tip is cylindrical, such that x-ray irradiation exiting the end of the waveguide and incident on the reflecting tip is reflected at a boundary between the first portion of glass and the second portion of glass.

Please replace the paragraph found on page 14, lines 5-11 of the specification with the following paragraph:

With radiation from lasers in the infrared and ultraviolet grazing incidence reflection from cylindrical glass tapers can be used. Theoretical calculations suggest a linear taper is the most efficient taper, and we have been able to produce close approximations to a linear taper in the laboratory. A diagram of a coupling taper 20 is shown in Figure 2. Preferably, an x-ray source 32 capable of producing a well-columnated beam can deliver an x-ray beam 22 into the wide end 21 of a linear taper in order to couple to the subject waveguide. Other shaped tapers, such as parabolic, can also be utilized with the subject invention.